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## THE SUPERMARKET TERRACE, NEAR EAST LIVERPOOL, OHIO

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An excavation for a building housing a supermarket in East End, Ohio, (east part of E. Liverpool) (Wellsville, Ohio, W. Va.-Pa. quadrangle map of the U. S. Geological Survey) uncovered terrace material of sand and gravel, about 25 ft thick, buried beneath a soil formed from colluvium, about 5 to 13 ft thick. Both of these layers of soil material contain pebbles of crystalline rock presumed to have been deposited during the Pleistocene Epoch. This locality is 7 miles south of the Illinoian till sheet boundary (White, 1951, Pl. 1).

The colluvium and the underlying sand and gravel are so deeply weathered that the author believes there is evidence here of a pre-Illinoian glaciation.

The soil morphology was studied to determine part of the Pleistocene history of the upper Ohio Valley.

### *Topography of the Supermarket Terrace and Physiography of the Vicinity*

The Supermarket Terrace is one of several terraces in the upper Ohio Valley (Hubbard, 1954, pp. 365-368; Leverett, 1902, pp. 88-98, 121-125; 1934, pp. 100-102) whose soil morphologies are under study by the author. The Ohio River, about half a mile to the south, is at 656 ft elevation. The flood plain is narrow and discontinuous. North of the river two terrace levels of gravelly alluvium at 720-700 ft and 770-740 ft occupy most of the inner Ohio Valley and underlie East End between the supermarket and the river. The Supermarket Terrace with its southward sloping colluvial surface is spread over a slope, 500 ft wide, at about 850-800 ft elevation. A remnant of a higher terrace stands 1000 ft to the north, at about 960 ft elevation. Ridgetop remnants of the dissected Allegheny Plateau are at 1160 ft in the immediate vicinity.

### *The Description of the Supermarket Terrace*

The Supermarket Terrace occupies a colluvial bench position ranging from 800 ft elevation at the supermarket to about 850 ft elevation 500 ft to the north. The excavation behind the supermarket reveals the following soil morphology:

THE OHIO JOURNAL OF SCIENCE 59(6): 332, November, 1959.

## Profile Description of the Soil of the Supermarket Terrace

Location	The west side of excavation behind supermarket, located in area bounded by Pennsylvania Avenue, Unity Street, Minnesota Street and City Limits, East Liverpool, NW $\frac{1}{2}$ NE $\frac{1}{2}$ Section 12, Liverpool Township, Columbiana Co., Ohio.
Slope:	15% slightly concave, 400 ft from base of steep slope;
Land Form:	Colluvial bench.
Elevation:	820 ft; Relief: 500 ft difference in elevation between river and ridgetops.
Soil Material:	Colluvium underlain by sandy and gravelly glacial outwash.
Drainage:	Moderately well drained class.

(Soil descriptive terminology used below follows usage of the Soil Survey Manual by the Soil Survey Staff), 1951, U.S. Department of Agriculture, Handbook 18, Washington, D.C.)

## Depth and

Horizon	Profile description (moist colors in Munsell notations)
0-12 in. A <sub>p</sub>	Dark grayish brown (10YR 4/2) silt loam; weak very thin platy structure; friable; channers 10% including a few pebbles; very strongly acid; boundary abrupt smooth.
12-20 in. B <sub>1</sub>	Brown (9YR4/4) channery loam with thin A <sub>p</sub> stains in vertical cracks, weak medium subangular blocky structure; friable; channers 25-50% including a few pebbles; extremely acid; boundary clear smooth.
20-38 in. B <sub>21</sub>	Dark brown (7.5YR4/4) channery loam with many coarse distinct reddish brown (5YR4/4) and grayish brown (10YR5/2) mottles; grayish brown (10YR5/2) prism faces; weak coarse prismatic structure breaking to moderate medium angular blocky peds; firm; channers 25% including a few pebbles; extremely acid; boundary clear wavy.
38-60 in. B <sub>22m</sub>	Dark brown (7.5YR4/2) channery fine sandy loam with many fine distinct gray (10YR5/1) and reddish brown (5YR4/4) mottles; grayish brown (10YR5/2) ped faces; weak fragipan breaking to moderate medium angular blocky peds; very firm; channers 25-40% including a few pebbles; very strongly acid; boundary gradual wavy. This horizon is the lower part of the colluvial material at this site. The colluvium ranges to 13 ft thick in excavation. Where this material is thicker than 60 in. it has a yellowish red (5YR4/8) color.
60-84 in. B <sub>31u</sub>	Strong brown (7.5YR5/6) fine loam with many medium distinct gray (10YR5/1) mottles and black Mn stains; thin gray (10YR5/1) clay ped faces; moderate coarse prismatic structure breaking to moderate fine angular blocky peds; friable; pebbles 7%; extremely acid; boundary clear smooth. This horizon is upper part of glacial outwash material.
84-116 in. B <sub>32</sub>	Strong brown (7.5YR5/6) loam to clay loam with many coarse distinct grayish brown (10YR5/2) mottles; grayish brown (10YR5/2) silty clay loam prism faces 5 mm thick and thin grayish brown clay ped faces; weak coarse prismatic structure breaking to moderate medium angular blocky peds; firm; pebbles 2%; very strongly acid; boundary clear smooth.
116-144 in. B <sub>33</sub>	Grayish brown (10YR5/2) fine loam with many coarse prominent strong brown (7.5YR5/6) mottles; thin grayish brown (10YR5/2) ped faces with clay flows ranging to 10 mm thick; moderate coarse angular blocky structure; firm; pebbles 10%; strongly acid; boundary clear smooth.
144-158 in. C <sub>1u</sub>	Brown (10YR5/3) gravelly fine sandy loam with many coarse distinct strong brown (7.5YR5/6) mottles; single grain; friable; pebbles 60%, pebble count of 1190 pieces:—soft brown oxidized sandstone 41%, oxidized chert 20%, quartz 20%, oxidized quartzite 8%, concretions 4%, siltstone 2%, red quartzite 2%, rotted granite 3%, very strongly acid; boundary abrupt smooth.
158-300 in. D <sub>1</sub>	Layers of brown (10YR5/3) and light brownish gray (10YR6/2) gravel, loam and silt loam with strong brown (7.5YR5/6) and yellowish red (5YR4/6)

mottles; single grain; noncoherent; weathered pebbles 10% in the layers of loam; strongly acid in upper part ranging to medium acid in lower part.

300-360 in. D<sub>2</sub> Grayish brown (10YR5/2) gravelly sandy loam to loamy sand; single grain; noncoherent; pebbles 40%, pebble count of 494 pieces:—fresh gray sandstone 65%, unoxidized shert 10%, unoxidized quartzite 6%, quartz 8%, concretions 6%, siltstone including some possible limestone ghosts 2%, fresh granites and gneiss 2%, hard red quartzite 1%; slightly acid in upper part ranging to neutral in lower part. This horizon is lower part of the glacial outwash.

360 in. + D<sub>4</sub> Very dark gray, thin bedded siltstone, unweathered at contact with glacial outwash.

TABLE 1  
*Physical\* and morphological data of soil and material of Supermarket Terrace*

Depth in inches	Horizon	sand 2-.05 mm	silt .05-.002 mm	total clay .002 mm	fine clay .0002 mm	pH	Thickness of clay skins	Macro structure/ micro structure
0-12	A <sub>p</sub>	32	50	18	2	4.4	none	weak very thin platy
12-16	B <sub>1</sub>	37	45	18	3	4.3	none	weak medium subangular blocky
16-20	B <sub>1</sub>	41	40	19	4	4.3	none	
22-28	B <sub>21</sub>	43	38	19	4	4.4	none	coarse prismatic/moderate med. angular blocky
32-38		55	29	16	5	4.4		
38-45	B <sub>22m</sub>	60	23	17	5	4.5	none	fragipan/moderate medium angular blocky
55-60		58	27	16	4	4.6		
60-65	B <sub>31u</sub>	45	32	24	9	4.4	thin	coarse prismatic/moderate fine angular blocky
80-84		36	38	26	9	4.4		
92-98	B <sub>32</sub>	33	40	27	8	4.6	5 mm	weak coarse prismatic/moderate med. angular blocky
110-116		31	42	27	9	5.0		
127-133	B <sub>33</sub>	31	43	26	8	5.4	1-10 mm	weak coarse angular blocky
144-158	C <sub>1u</sub>	60	21	19	6	5.2	none	single grain
166-172	D <sub>1</sub>	31	51	17	5	5.2		single grain
178-184		48	38	14	4	5.3		
214-218		38	47	15	5	5.2		
248-252		37	49	14	4	5.4		
274-278		32	53	15	5	5.5		
328-332	D <sub>2</sub>	57	31	12	3	5.9		single grain
350-360		73	20	7	2	6.8		

\*Mechanical analysis made by the Ohio Agricultural Experiment Station, at Columbus, Ohio.

*Soils of Other Terraces*

Remnants of the high level terrace of the upper Ohio Valley occur about 100 ft higher in elevation and 1000 ft north of the supermarket; in vicinity of River-view Greenhouse, north ½, Section 18, Liverpool Township; in vicinity of Spring Grove, south ½, Section 36, Liverpool Township; in Hamond Park and Spring hill Cemetery in northeast ¼, Section 10, Yellow Creek Township; and in West 18th Street Heights in Wellsville (above Vulcan). The alluvium at these places contains pebbles of crystalline rocks, is presumed to be glacial outwash, and is more deeply weathered than that of the Supermarket Terrace. It is buried by colluvium

near valley walls. The detailed description of the soil morphology of this highest terrace will be reported when the study is completed.

A terrace at 770–740 ft elevation underlies the general area between the supermarket and the Ohio River in East End (Leverett, 1934, pp. 100–102). It is composed of glacial outwash and is much less weathered than the Supermarket Terrace at 850–800 ft.

A lower terrace occurs at 720–700 ft elevation which is comparatively little weathered and contains relatively fresh gravelly glacial outwash near its surface.

The morphologies of the soils of both the 770–740 and 720–700 ft terraces are also under study and will be reported when the study is completed. Little or no colluvium is present on these two lower terraces.

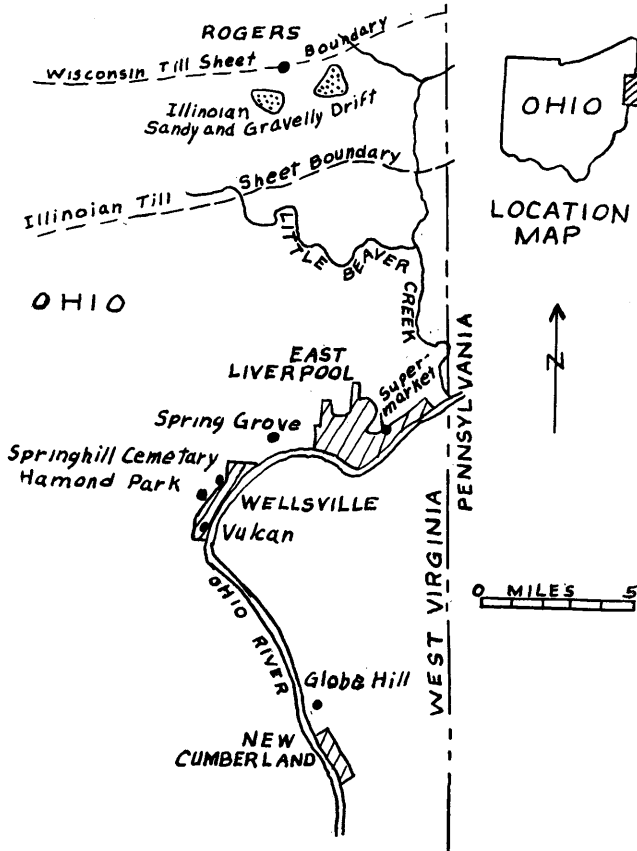


FIGURE 1. Map of the Upper Ohio Valley Near East Liverpool, Ohio.

A colluvial bench, underlain at several places with gravel, extends eastward from the Supermarket Terrace to the state line and is preserved in remnants up Little Beaver Creek at 100–150 ft above stream level. This colluvial bench occupies a similar relative position and elevation to the Supermarket Terrace. While good exposures are lacking and its genesis is uncertain, this colluvial bench possibly belongs to the same geological event as the Supermarket Terrace. The colluvial bench is not found on the Little Beaver tributaries and probably predates the formation of their present entrenched valleys.

A terrace remnant at 860 ft elevation,  $1\frac{1}{2}$  miles downstream from the Supermarket Terrace, at the corner of Pennsylvania Avenue and Blakley Streets in East Liverpool, is mantled by a very deeply weathered glacial outwash, over 12 ft thick. The soil on the crest of the remnant is a re-exhumed paleosol juxtaposed to another soil, developed in a less weathered gravelly alluvium, which buries the paleosol on the south side slope of the terrace remnant. The subsoil of the paleosol is a yellowish red sandy clay loam with structure and clay formation extending to an 8 ft depth. The pebbles of granite in the paleosol at an 8 ft depth are rotted so that only their ghosts remain. This degree of weathering and the position of the 860 ft terrace is similar to that of the Supermarket Terrace; however, the soil morphology differs because the 860 ft terrace is somewhat excessively drained and not covered by colluvium. The gravelly alluvium, which buries the paleosol on

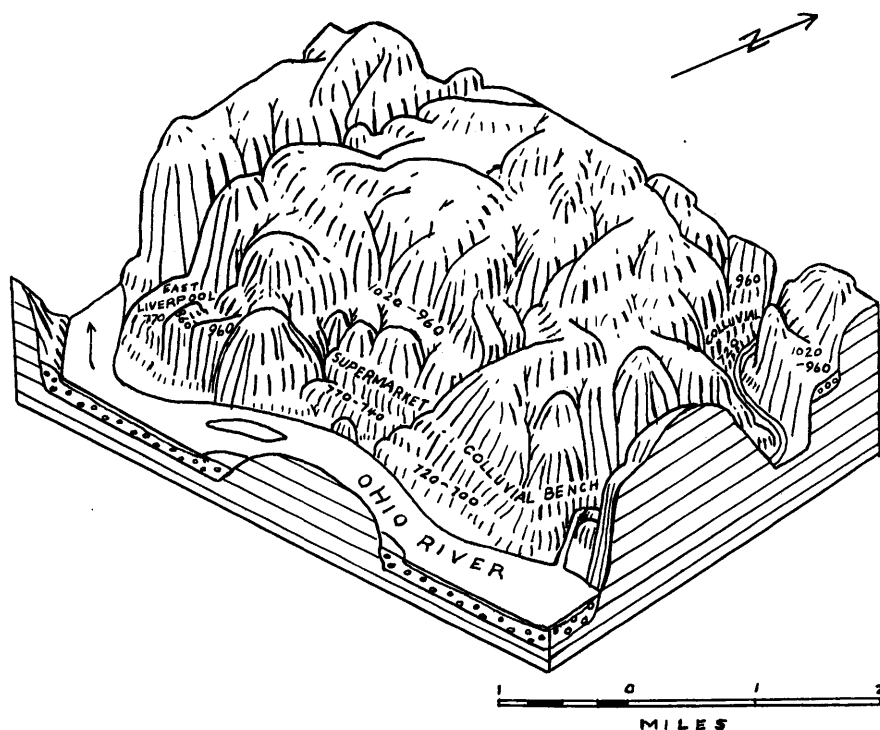


FIGURE 2. Diagram of Landscape in the Vicinity of the Supermarket Terrace. Little Beaver Creek on right. East Liverpool and East End along the river. Village of Grimms Bridge in valley of Little Beaver Creek, in upper right corner. Various terrace levels are designated by elevations or names.

the south sideslope of the terrace, is only a few feet thick where it can be observed and no attempt to interpret it will be made here. It is younger than the outwash in which the paleosol is formed and 90 ft higher than lower, less weathered glacial drift. This must be considered in further studies of various terrace levels in the vicinity.

#### DISCUSSION

The soil morphology of the Supermarket Terrace is complex because the glacial outwash is buried by 5 to 13 ft of colluvium. This colluvium protected the glacial outwash from some chemical weathering and soil formation.

The author examined the  $B_{31u}$  soil horizon (upper part of the glacial outwash) searching for a buried paleosol. No buried  $A_1$  or evidence of an  $A_2$  horizon was found here during field examination. The mechanical analysis (table 1) shows a slight clay accumulation in the lower part of the  $B_1$  and upper part of the  $B_{21}$  horizons but not enough to class them as textural B horizons. They can be classed as structural and color B horizons. Clay has accumulated or formed in the  $B_{31u}$ ,  $B_{32}$ , and  $B_{33}$  horizons, formed in the glacial outwash.

It is probable that the glacial outwash was buried soon after its deposition because there was not enough time for a soil to form before it was buried by colluvium. Since colluvium is meager or lacking on lower and younger terrace levels, the colluviation apparently occurred before the latter were laid down.

Chemical weathering and soil formation extend through the colluvium into the glacial outwash to a 12 ft depth, clay is formed to 25 ft, and carbonates are leached throughout the 30 ft thickness of unconsolidated material. Pebbles of granite are rotted at 13 ft and pebbles of limestone have completely decomposed and are lacking throughout the profile.

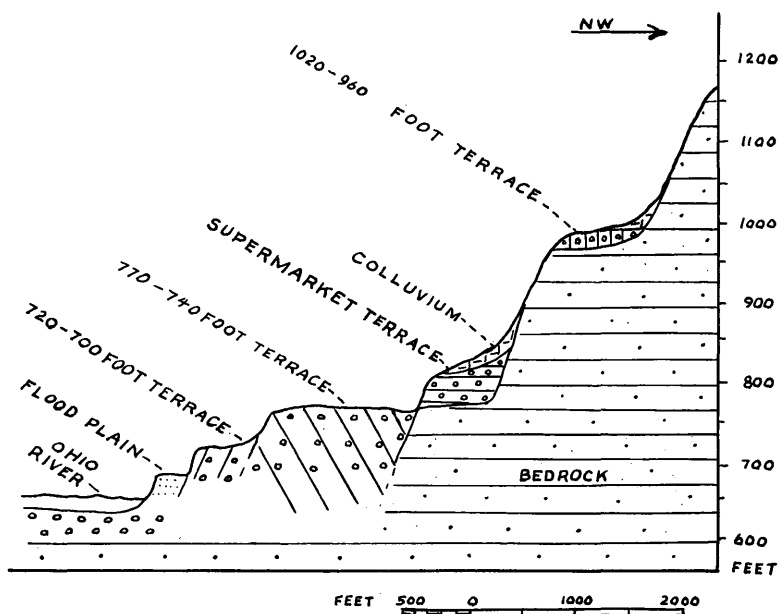


FIGURE 3. Section of North Side of Ohio Valley Near the Supermarket Terrace.

The elevation and weathering of the Supermarket Terrace are similar to those of a gravelly layer mantling part of the terrace at Globe Hill (Lessig, 1959, pp. 48-54),  $2\frac{1}{2}$  miles north of New Cumberland, West Virginia, and 15 miles downstream from the Supermarket Terrace; and a terrace in East Liverpool at the corner of Pennsylvania Avenue and Blakley Streets. However, the soil morphologies of these terraces are different because they are formed from a somewhat excessively drained gravel and not buried by colluvium while the soil of the Supermarket Terrace is formed under only moderately well-drained conditions, due to receiving seepage from upper slopes, and is buried by 5 to 13 ft of colluvium.

The soil morphology and the weathering of the material of the Supermarket Terrace indicate a greater age than that of Illinoian sandy-gravelly drift, a few miles to the north, at such places as  $\frac{1}{4}$  mile south of Rogers (White, 1951, p. 970)

and 2 miles east of Rogers at 1130 ft elevation in NW  $\frac{1}{4}$  Section 16, Middleton Township, Columbiana County, Ohio. Illinoian drift at these places is leached to a 15-18 ft depth; granite pebbles have only weathered rinds and solums in sandy loam material are developed to only a 4 to 6 ft depth.

The 770-740 and 720-700 ft terraces underlying East End are parts of two general terrace levels throughout the upper Ohio Valley and along Little Beaver Creek. The soil of the 770-740 ft terrace appears to be similar to the soils of the Illinoian sandy-gravelly drift near Rogers and the soil on the 720-700 ft terrace appears to be still younger. Soils developed on these terraces are being studied at more advantageous locations than in East End and will be reported when their study is completed. Their age is uncertain but younger than the Supermarket Terrace.

The 1020-960 ft terrace, 100 to 160 ft higher and more deeply weathered, is presumed to be older than the Supermarket Terrace.

#### CONCLUSION

The Supermarket Terrace is similar in weathering and elevation to the terrace at Globe Hill, on the West Virginia side, 12 miles downstream, and a terrace in East Liverpool,  $1\frac{1}{2}$  miles downstream although it is mantled with different soil material and has a different soil morphology.

The solum of the Supermarket Terrace is 12 ft thick which is thicker than the solums developed from Illinoian sandy-gravelly glacial outwash a few miles to the north and is older than two other terrace levels at 770-740 and 720-700 ft in the immediate vicinity.

The Supermarket Terrace was deposited during a glacial stage that is older than the Illinoian stage of glaciation but younger than the stage during which the earliest glacial outwash terrace was deposited in the upper Ohio Valley. It apparently belongs to a second stage of glaciation of the Allegheny Plateau.

The glacial outwash material of the Supermarket Terrace was buried by thick colluvium soon enough after glaciation so that there was not enough time for a soil profile to be formed from the glacial outwash before being buried. Such thick colluvium is common to the terrace level of the Supermarket Terrace in the upper Ohio Valley and along Little Beaver Creek.

Correlation of the various terraces in the upper Ohio valley must await completion of studies being conducted on the 1020-960, 760-740 and 720-700 ft terraces and on their relation to drift sheets to the north.

#### ACKNOWLEDGMENTS

The Author is indebted to Dr. George D. Hubbard and Dr. George W. White for their encouragement, review, and field assistance in this and other pedologic studies in the upper Ohio Valley, and to Dr. H. H. Morse for his comments on the manuscript.

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